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ABSTRACT

The paper examines ways in which computers have radically altered and improved the lives of handicapped students. The visually impaired have been helped through the use of computerized braillers, embossers, and readers. Both adaptations of off-the-shelf software and specialized software have provided the visually impaired with magnification of print on the computer screen, voice synthesis, Braille word processing, and access to databases of assistive devices. Microcomputers have given the hearing impaired access to telephone communication (the Telecommunications for the Deaf device), lip reading training, synthesized speech, and computer assisted instruction. Finally, computers can help the nonverbal physically handicapped student to communicate and peripherals (such as speech synthesizers, talking scanners and keyboards, touch sensitive screens, keyboard emulators, keyboards, and adaptive switches) can provide access to off-the-shelf software. High costs and lack of information are still barriers to the widespread use of these computerized inventions. A resource list of 17 computer hardware and software companies and 8 publications is appended, as well as a 35-item reference list. (DB)

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Computers and the Handicapped: A Primer

Mary P. Deming, Ph.D. and Maria Valeri-Gold, Ph.D.

For the past few years, the affordable and easy-to-use microcomputer has been heralded as one of the most innovative tools to arrive on the educational scene. Educators on every level have rapidly become admirers of the computer's multifaceted ability as an administrative and curriculum aid. So too, rearchers have been quick to investigate the effectiveness of these machines in helping students of all ages to learn. However, as more and more results of these numerous studies are being released, educators' original unbridled enthusiasm is being quickly tempered by various studies' mixed results. So it now seems, that perhaps computers by themselves are not the educational panacea that they were once thought and hoped to be.

There is, however, one field that computers have made unequivocal and earth shattering, visible results, namely that of special education. For in many cases, computers have radically altered and improved the lives of handicapped students by helping them to overcome or compensate for their handicaps and have in particular, helped non-speaking special students to communicate for the first time in their lives. Computers can miraculously improve the quality of life of students who suffer from a whole

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range of handicapped conditions, for computers can be easily adapted, so that the visually impaired, the hearing-deficient and the physically handicapped can participate fully in the social, academic and economic aspects of their lives.

COMPUTERS AND THE VISUALLY IMPAIRED

Computer hardware and software products have broadened the experiences of the visually impaired and have helped bridge the gap between the seeing and the nonseeing world. Through the use of computerized braillers, embossers, and readers, the visually impaired can attend college classes, hold well-paying jobs, read books and magazines and generally participate in a whole realm of activities once difficult for them to enroll in without the aid of a seeing person.

The main form of writing for the blind is braille, a system of communication which uses a quadrangular cell consisting of a combination of raised dots. (Hallahan & Kauffman, 1982, p.299). Originally, braille was written by hand, first using a slate and stylus and then later in history, the Perkins Brailler which contained six keys, one for each dot, was used by most blind persons. These manual braillers would emboss print on a page of paper. (Hallahan & Kauffman, 1982, p. 299). Presently there are computerized braillers that can quickly and easily transmit, store, and retrieve information in braille. So, students with a portable keyboard can now write letters, take class notes, or translate hard copy to braille with computerized braille systems that make the work faster and at the same time,

eliminate the physical toil of non-computerized braillers. Some computerized braillers can read braille out-loud in a synthesized voice for students to hear at their leisure, while other braillers can translate off-the-shelf software for greater accessibility to computer products for blind students.

Computerized embossers are to the blind world what computer printers are to the seeing world. Embossers are used to create hard braille copies for visually impaired students to read. Some computerized embossers translate various grades of braille, use graphics, and can print both braille and nonbraille products alike. Many of these embossers can run standard software packages, can store information on cassette tapes, and can be networked with a variety of computer terminals.

Computers have also opened up a very special door for visually impaired students, for they have allowed these students to read regular printed materials. Previously, visually impaired students have had to depend upon large-sized printed books, tape-recorded materials or human readers. Computerized readers now allow visually impaired students to engage in the joys of reading because the computer translates the printed word, through an optical recognition unit, into a synthesized voice. For example, with the grandaddy of all computerized readers, the Kurzeil Reader, visually impaired students place printed material face down on a glass plate on the top of the computer and as the computer scans this material, it reads it out loud in a clearly understandable voice capable of translating the printed material

into six languages. As if talking in six languages is not enough, this computer also includes a speaking calculator. Other capable, yet less costly readers also are presently on the market for the visually impaired.

Off-the-shelf software can be easily adapted for the visually impaired through the use of special keyboards and voice synthesizers. Also specialized software has been developed particularly appropriate for the visually impaired. Software products like in-LARGE (Berkeley System Design) and LoVE (Finally Software) magnify print on the computer screen and can be connected to voice synthesizers. Raised Dot Products offer a wide range of software especially designed for the visually impaired. Their software includes a multi-media word processor, Braille Edit X, and a braille translation program, Hot Dots plus special adaptive equipment. Other word processing programs especially suited for the blind include: Word-Talk (Computer Aids Corporation), VERBalSTAR (Computer Conversations), and Prowords (Access Unlimited-SPEECH Enterprises). Talking Sensible Speller for ProDOS (Sensible Software, Inc.) is a talking spelling checker with a 80,000 word plus dictionary which can be used on an Apple computer and with a Echo II speech synthesizer. Data bases such as ABLEDATA (The National Rehabilitation Information Center), ACCENT ON INFORMATION (Accent on Information), and ASSISTIVE DEVICE DATABASE SYSTEM (Assistive Device Resource Center) can help the visually impaired to retrieve information, store it in their computers and retrieve it at their leisure for

review.

COMPUTERS AND THE HEARING IMPAIRED

Computerized materials also have a profound effect on the hearing impaired in today's society. According to an informational pamphlet produced by the National Institute for the Deaf in 1985, "hearing impaired is a general term used to describe and encompass all types of hearing defects, ranging from one minute loss to profound deafness. It is the single most prevalent chronic physical disability affecting more than 13 million Americans." Since the birth of the computer, however, positive results have been produced which enable the hearing impaired to "hear," for hardware and software materials adaptable and implementable for all academic and nonacademic fields have been successfully designed for the the hearing impaired population.

Accessibility to telephones, which most Americans take for granted, was once impossible for the hearing impaired. Now the invention of a small, typewriter-like device called the TDD (Telecommunications for the Deaf) allows the hearing impaired to communicate over the phone. This marvelous machine consists of three components: a typewriter-like keyboard, an electric coupler or modem on which the handset of a phone is placed and a read-out display where messages are shown. Various read-out displays are available: a printer, either built-in or cabled-in, which records messages on paper; an electronic light emitting diode (LED) or liquid crystal diode (LCD) that displays messages on a television

screen. Some TDD's also have built-in memory chips to store and retrieve information, and TDD models may be stationary or portable.

Newer versions of the TDD's have been created by Ultra Tec. The MiniCom IV has a four-row typewriter-style keyboard with a twenty character display. This machine contains a built-in printer port to hook-up to an external printer and can be directly connected to a telephone line. Superprint, another TDD model, consists of a four-row keyboard with a twenty character display and has the ability to save and send messages on a twenty-four character printer. This model also features automatic answering and keyboard dialing characteristics. Still another model, Intele-Type TDD, allows the hearing impaired via a computer network to call friends, balance checkbooks, take classnotes and type letters with its eighty-column letter quality printer, sixteen character LCD display, 3.7K typewriter/message memory and built-in calculator. All the above mentioned TDDs are AC or battery operated and come with built-in handles and case covers.

In addition to computer hardware, computer software programs and interactive computer networks also expand the horizons for the hearing impaired. For example, the ILLIAD, a software program with a touch sensitive screen helps hearing impaired students to experiment with new vocabulary and sentence patterns. (Ward, 1983, p. 347). Another software package, the Lip-Reader Trainer, converts typed sentences into animated mouth movements on the

computer screen. In doing so, this program reinforces lip reading skills and is designed to help deaf students to produce correct mouth configurations. Additional perhipheral equipment can be used in conjunction with this program to produce voice output and to develop sentence libraries. (Hight, 1982, p. 565).

An innovational instructional system called DAVID (Data Analysis in Videointeractive Device) also teaches lip reading. This video interactive device utilizes a Wang mini-computer, a keyboard, a disk storage system, a printer, and a videotape recorder. So, hearing impaired students can learn lip reading through the link-up of videotaped segments with computer-assisted instruction. (Sims, 1979, p. 619). Another media-based interactive visual image contoller instruction delivery system for the hearing impaired is the VIS-I-CON. Unlike the DAVID, it is a programmable media-based microprocessor-controlled device which utilizes super 8 film and addressable audiotape messages. (Fox, 1979, p. 605).

The PLATO IV SYSTEM housed at the University of Illinois and various other institutions of higher learning around the country, has also offered new learning experiences for the hearing impaired. Through the availability of over 1100 terminals located at 185 plus sights, the hearing impaired can use special adaptive equipment such as touch sensitive screens and/or voice synthesizers to key in on over 1600 hours of lesson materials covering 150 subject areas. PLATO also provides programs particulary designed for the deaf. One such program teaches deaf

children to understand speech sounds which are first presented to the children as touch patterns on their abdomens. Other special programs offer pictorial displays, detailed teacher-prescribed assignments, automatic adjustment of lesson difficulty to individual student performances, and powerful methods of response-interpretation in the teaching of the hearing-impaired. (Saunders, 1978, pp. 20-22).

COMPUTERS AND THE PHYSICALLY HANDICAPPED

Computer technology has also greatly opened up the world for the physically handicapped. Physically handicapped students may be defined as those "whose nonsensory physical limitations interfere with learning to such a degree that special services, training, equipment, materials or facilities are required." (Hallahan & Kauffman, 1982, p.324). These students may suffer from neurological impairments, muscoskeletal conditions, congenital malformations, or the results of an accident. Their illnesses may include cerebral palsy, spina bifada, epilepsy, multiple scelerosis, muscular dystrophy, or a combination of these or other diseases. (Hallahan & Kauffman, 1982, p.324). Computers help these types of students primarily in three ways: they allow handicapped students to communicate with others and the outside word, they assist handicapped students in accessing regular software, and they help students to overcome barriers to their environment.

For nonverbal handicapped students, computers can be used to help them communicate. Two such communication products are

manufactured by the Prentke Romich Company. The Touch Talker and Light Talker used in conjunction with the Miniexpress software program allow nonverbal students to store communication messages via pictures or symbols in a light, compact portable computer. When nonverbal students wish to communicate, they activate the symbols by a touch or a light sensor, or a control switch which is connected to a part of their bodies in which they have voluntary control. These switches may be connected to their heads, or their eyebrows, or their mouths or any other body part which they can move. After these symbols for communication are activated, a computer translates the message into synthesized speech, so that handicapped students can participate in simple conversations, perhaps asking for the time or for something to eat. (Prentke Romich 1986 Catalog).

Computers also allow handicapped students to access off-the-shelf software through speech synthesizers, talking scanners and keyboards, touch sensitive screens, and other adaptive peripherals, such as keyboard emulators, keyguards and adaptive switches. Computers can also help physically handicapped to control their environment. Both the Touch Talker and the Light Talker permit students to control lamps, appliances, phone, beds, door openers and call systems, thus freeing them from always having to depend on human helpers.(Prentke Romich 1986 Catalog).

CONCLUSION

Even though all these inventions have improved the quality of life for the handicapped, two problems still exist concerning

their availability and use: cost and information. Many of these computerized inventions are still too costly to be afforded by the majority of handicapped students. For example, one computerized reader for the blind sells for almost $20,000 and some communication systems for nonverbal students cost almost $2000. Fortunately, funding sources, on the local and national levels, are now trying to even out these prohibitive costs to make computers more financially available to a larger audience. Many of these computerized tools can be rented reasonably rather than purchased. Still many more solutions must be provided to reduce the cost of these machines and to increase funding for their purchase.

Both families and educators of the handicapped are often bewildered where to seek information concerning computer applications for special students. Listed at the end of this article are resources related to computers and the handicapped. A good starting point for acquiring necessary information is by reading the noteworthy bi-monthly publication, Closing the Gap. The purpose of this newspaper is to present the latest information concerning computer applications for the handicapped. This organization also offers regional workshops, a national conference, and a yearly printed resource directory for applicable computer hardware and software.

Even though handicapped students are still the minority in our classes and learning labs, they are guaranteed to an equal and quality education no matter what means or cost it might take

to assure this goal. Computers can competently assist in reaching this goal, but informed, caring computer-literate educators can assure it.

RESOURCES

Computer Hardware and Software Companies

Accent on Information
P.O. Box 700
Bloomington, IL 61701

Access Unlimited-SPEECH
P.O. Box 10622 Fairlane Drive
Houston, TX 77024
713-461-1666

Assistive Device Resource Center
California State University
6000 J Street
Sacramento, CA 95819
916-454-6422

Berkeley System Design
1708 Shattuck Avenue
Berkely, CA 94709
415-540-5537

Closing the Gap
P.O. Box 68
Henderson, MN 56044
612-248-3294

Computer Aids Corporation
124 W. Washington, Ste. 220
Fort Wayne, IN 46802
219-422-2424

Computer Conversations
6297 Worthington Road, S.W.
Alexandria, OH 43001
614-924-2885

Finally Software
4000 MacArthur Boulevard
Newport Beach, CA 92693
714-854-4434

Heath Resource Center
One Dupont Circle
Suite 800
Washington, D.C. 2036-1193

Kurzweil Applied Intelligence
411 Waverley Oaks Road
Waltham, MA 02154
617-893-5151

National Association for Hearing and Speech Action (NAHSA)
10801 Rockville Pine
Rockville, Maryland 20852
1-800-638-8255 TDD/VOICE

The National Rehabilitation Center
4407 8th Street N.E.
Washington, D.C. 22017
202-635-5826

National Technical Institute for Deaf and Rochester Institute of Technology
One Lomb Memorial Drive
P.O. Box 9887
Rochester, NY 14623-0887
716-475-6824 (Voice or TDD)

Prentke Romich Company
1022 Heyl Road
Wooster, OH 44691
216-262-1984

Raised Dot Computing, Incorporated
408 S. Baldwin Street
Madison, WI 53703
608-257-9595

Sensible Software
210 S. Woodward, Ste. 229
Birmingham, MI 48011
313-258-5566

Telecommunications for the Deaf, Incorporated
814 Thayer Avenue
Silver Springs, Maryland 20910
301-589-3006 (Voice or TDD)

Aids and Appliances Review, a quarterly from the Carroll Center for the Blind, 770 Centre Street, Newton, MA 02158 (617-969-6200). Back issues cost $1.25.

A Beginner's Guide to Personal Computers for the Blind and Visually Impaired covers basic concepts and some reviews of popular systems from the National Braille Press, 88 Stephen Street, Boston, MA 02115 (612-266-6160).

Braille Research Newsletter available in Braille or print for $6 per issue from National Braille Press, 88 Stephen Street, Boston, MA 02115 (615- 266-6160).

Closing the Gap, a bimonthly newspaper on computers, primarily for special education but runs numerous ads and news items about computerized devices and computer peripherals and publishes an invaluable resource guide yearly. This newspaper is available for $21 a year from Closing the Gap, Box 68, Henderson, MN 56044 (612-248-3294).

Communication Outlook, a quarterly on communication disabilities and augmentative technology. Available for $17 year from the Artificial Language Laboratory, Computer Science Department at Michigan State University, East Lansing, MI 48824 (517-353-0870).

Computer Disability News is a free new publication from the National Easter Seal Society, 2032 West Ogden Avenue, Chicago,IL. 60612

Raised Dot Computing Newsletter is a newsletter detailing this and other companies' products for the visually impaired. Subscriptions may be obtained from Raised Dot Computer Products, 408 S. Baldwin Street, Madison, WI 53703 (608-257-9595).

Sensory Aids Technology Update is a newsletter available in print or cassette for $30 a year from Sensory Aids Corporation, 399 Sherman Avenue, Suite 12, Palo Alto, CA 94306 (415-329-0430).

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